

THE
DESCRIPTION AND USE
OF
N A I R N E's
Patent Electrical Machine:

WITH THE ADDITION OF SOME

PHILOSOPHICAL EXPERIMENTS

AND

MEDICAL OBSERVATIONS.

THE EIGHTH EDITION.

L O N D O N :

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THE
DESCRIPTION AND USE
OF
N A I R N E's
Patent Electrical Machine.

THOUGH this machine and its apparatus are constructed with a particular view to the purposes of medicine, yet it will be found equally applicable to philosophical uses. All its parts are insulated in the best possible manner; and, from the expense and study which the inventor has bestowed to render it perfect, it is much superior in its action to any machine of the size yet made. In the following description, the same letter of the alphabet is used to denote the same thing in all the engravings, and every attention has been paid to make the whole intelligible and clear.

C H A P. I.

A DESCRIPTION OF THE PARTS OF WHICH
THE MACHINE IS COMPOSED.

PLATE I. contains a perspective view of the machine, all its parts being properly put together. The letters of reference in the present chapter respect this plate, except where it is otherwise mentioned.

A. The glass cylinder.

B B. Two glass pillars, which support the glass cylinder A.

C. The handle, by which the glass cylinder A is turned.

R and G. Two metallic conductors.

D D. Two glass pillars, one supporting the conductor R, and the other G.

E. The board, into which the pillars B B, which support the cylinder A, are fixed,

F F,

FF. Two pieces of wood. In these pieces are fixed the pillars D D, which support the conductors R and G.

H H. Two knobs of brass soldered on the outside of each of the conductors R and G.

I. The cushion, which is attached, by a contrivance hereafter-mentioned, to the side of the conductor R, between that and the cylinder A. The end of it is seen at Plate III. Fig 1, 2, and 6.

K. The silk, one end of which is glued to the under part of the cushion I. It is turned over upon the cylinder A, so that part of the silk is between the cylinder A and the cushion I.

L. A screw of wood which passes through a slit in the upper part of the board E into the piece F, which, by screwing, draws the piece F up against the bottom of the board E. The use of it is to keep the glass pillar, which is fixed in F, which supports the conductor R, to which the cushion is attached, in its place, when

the cushion is pressed gently against the cylinder A.

M. The points which are foldered to that side of the conductor G which is next the cylinder A. They are only seen at Plate III. Fig. 2.

NN. The ends of the conductors R and G, which may be taken off from the other part, as represented Plate V. Fig. 1, 2.

S. An electrical-coated glass jar fastened in the inside of the conductor G. In the inside of this jar is fitted a piece of cork, and in the cork a small glass tube coated, and likewise a brass wire with a ball, which are seen Plate V. Fig. 1, 2.

The internal part of the conductor R is fitted up exactly in the same manner.

PP. Are knobs of brass screwed fast to the board E. A piece of tin foil is pasted on the board, so as to make a metallic communication between them. This piece of tin-foil is represented by the two parallel lines in Plate I. in Plate IV. Fig. 1; and Plate V. Fig. 1.

O.

O. The electrical stool, with its four glass legs. On the top of the board of the stool is fastened a piece of lead communicating with two holes, into either of which holes the end of one of the tubes with the pliable joints f f f Plate II. are to be put, the other end being connected with either of the conductors. See Plate IV. Fig. 1 and 3.

Q. A large sheet of paper to place the glass legs of the stool on. It is used to prevent the dust or lint flying up from the floor or carpet to the stool when electrified. See Plate IV. Fig. 1 and 3.

CHAP.

C H A P. II.

A DESCRIPTION OF THE APPARATUS.

P LATE II. contains drawings of the apparatus, not described in the preceding chapter. In this plate the parts are represented as detached from the machine; but the plates referred to are those in which their application is shewn.

a. An iron clamp, or vice, Plate IV. Fig. 1.

b. An iron chain, with a brass ring at each end, Plate I. Plate III. Fig. 1; Plate IV. Fig. 1; and Plate V. Fig. 1, 2.

c. A piece of card paper, with a round piece of leather glued to it, on which the amalgam is first spread, before it is applied to the glass cylinder A.

d. A compound joint, which has not only a vertical, but also an horizontal, motion, when applied to the conductor

R

R or G, Plate III. Fig. 1, 2, 5, 6; Plate IV. Fig. 1, 2.

c c c. Three metallic tubes, connected by means of two wooden joints: they are here represented as screwed to d, Plate III. Fig. 1, 2, 3, 4.

f f f. Three metallic tubes, connected by means of four pieces of wood, and two pliable or flexible joints, Plate I, Plate III. Fig. 5 and 6; Plate IV. Fig. 1, 2, 3.

g. A piece of wood fixed to one of the tubes f, and which has a hole at right angles to the tube into which one end of the glass handle k is put, Plate I. Plate III. Fig. 5 and 6; and Plate IV. Fig. 1, 2, 3.

h. A metallic ball, screwed to the end of one of the tubes f or c, Plate I. Plate III. Fig. 1, 2, 5, 6; Plate IV. Fig. 2 and 3.

i. Brass or wooden conical points, Plate III. Fig. 3 and 4.

k. Glass handle, Plate III. Fig. 5 and 6; Plate IV. Fig. 3; Plate V. Fig. 2.

l. Clamp or vice of wood, Plate IV. Fig. 2.

m. Metallic cord, covered with worsted, Plate IV. Fig. 2 and 3.

n. Electrometer, Plate V. Fig. 1 and 2.

o. Metal chain, with a ring at one end, and at the other a piece of brass wire, Plate V. Fig. 1 and 2.

p. Piece of wood, with the brass wire of o fixed to it, and which has a hole at right angles to the wire, in which one end of the glass handle k is put, Plate V. Fig. 1 and 2.

q. Screw-driver for tightening the side joint of d.

r. Forked screw-driver for tightening the vertical joint of d, and also the two joints of e.

s. Pointril, to be put into the small hole at the end of one of the tubes e or f, to unscrew them, in case they should get too tight to be unscrewed by hand from the joint d.

t.

t. Luminous insulated discharging-rod, invented by Edward Nairne.

u. Communicator, (so called from its making a metallic communication from the outside to the inside coating of the large jars,) and which is to be applied over the edge of the jar S, Plate V. Fig. 1, when the glass tube within the said jar is to be used for the gentler shocks or vibrations, as directed Chap. IV. §. 29.

With each electrical machine, which has the complete medical apparatus, there are sent two sets of that part of the apparatus marked b, c, d, e e e, f f f, i, k, o p; and also six balls of three different sizes, viz. two of each size; and likewise two coated electrical jars, and two coated glass tubes, viz. one of each fixed in each conductor. It must be observed, that the tubes e e e unscrew only from the joint d. No attempts should be made to unscrew any other part, except the balls or points that may occasionally be screwed on at the other end. The same likewise must be observed

observed of the tubes f f f, excepting that the tube, to which g is fixed, may be unscrewed out of the piece of wood which connects it to the flexible joint, g f h, Plate II.

C H A P.

CHAP. III.

DIRECTIONS FOR PUTTING THE PARTS
OF THE ELECTRICAL MACHINE PRO-
PERLY TOGETHER, AND PREPARING
IT FOR USE.

1. **H**AVING lifted the machine out of the box, by taking hold of the wood-work of the glass cylinder A, set it upon a table, as represented Plate I. on which it is to be used, and fasten it there by means of the iron clamp a, Plate II.

2. The handle C, which is reversed for the conveniency of packing the machine in a shorter box, is now to be reversed to what it was when taken out of the box.

3. Now take off the cushion I, with its silk K, from the conductor R, which
is

is easily done, by taking hold of the cushion, and drawing it towards that end of the machine which is farthest from the handle C. Observe, before you take the cushion off, how it is attached to the side of the conductor R, viz. by means of two brass screws, which are screwed into the wood of the cushion, and go between the flits in the two pieces of brass that are blacked, and soldered to the conductor R.

4. The cushion being off, take a clean, warm, dry, soft, linen cloth, not very old, as they are apt to have the lint come off,* and wipe all the parts till they are very clean and free from damp or moisture;† particularly the glass cylinder A, and

* Or any piece of silk or flannel, if it be made very dry and warm.

† *Note.* A small quantity of *dry* chalk or whiting, rubbed on any of the cloths with which the machine and apparatus are wiped, will be found to be very useful in taking off the damp or moisture which may adhere to any part of it.

the

the pillars B B and D D. This should be done every time the machine is used, and likewise while it is using, if worked for any length of time; and the reason for its being necessary to wipe it again, after having been once completely done, is, that the electricity attracts the dust and light substances from the room, which adheres to the glass pillars, cylinder, &c. and makes the insulation less perfect, therefore it is requisite to wipe away any dust, &c. it may contract while using. Also particularly observe that every thing be removed from the table (unless it be a very large one) on which the machine is fixed, and that it be free from dust; but, above all, a lighted candle must not be brought near it when you are exciting the cylinder. These and other minutiae should be carefully attended to when you wish the machine to produce its greatest effect, and for want of attention to them it may appear not to work well, and the cause not be at first perceived. If the

B

air

air be very moist or damp, or the machine has been kept in a damp place, (which should be avoided, if possible,) it will be proper to dry the whole machine gently, *except the cushion*, by placing it at a distance of about four feet from the fire: but this will be very seldom necessary, if the machine is used in a room with a fire. The cushion I, with its silk K, must also be wiped clean from dust; and any amalgam, which may loosely adhere to them, must also be wiped off. The wood of the cushion being *damp* is no inconveniency, but rather an advantage.* Should the silk K be damp, it must be wiped with a warm linen cloth, which will dry it sufficiently.

* *Note.* Sometimes the table and the floor are so dry as to prevent the cushion from being supplied with the electrical fluid from the earth. In that case, the chain b, hanging from either conductor, must be connected with a quantity of metal, such as the fire-grate in the room, or leaden pipes communicating with water or moist earth.

5. The

5. The cushion is now to be replaced, by slipping the two screws into the two flits, in the pieces soldered to the conductor R, §. 3; always observing that the silk K lies on the glass cylinder A, and passes between the leather of the cushion and the cylinder, so that the edge of the silk K, farthest from the cushion, to which it is either glued or pasted, may be near the points M, viz. within about half an inch: but observe that the edge of the silk must not touch the points. If it does, it must be cut shorter. See Plate III. Fig. 2.

Now gently press the cushion with the silk against the glass cylinder A, by moving the slider F farther under the board E, and fixing it there by the screw L. See L. Chap. I.

6. Next observe that one of the brass rings of the iron chain b hangs on the brass knob H of the conductor R, the other end resting on the table.

B 2

7. Turn

7. Turn the silk from off the glass cylinder A back on the conductor R.

8. The machine being prepared according to the foregoing directions, take one of the pieces of card c, Chap. II. and Plate II; with the leather glued on it, on which some amalgam is spread ;* rub the amalgamed part of the leather on the glass cylinder A, about ten or twelve times backwards and forwards, in the direction of its length, on that part which is near the cushion ; at the same time gently turning the handle, so that the upper part of the cylinder may pass from the cushion

* The amalgam is made by melting five parts of mercury with one of zink ; and, when cold, is mixed with any kind of fat. I commonly use hog's lard, about a fortieth part of the whole weight.

If sometimes the amalgamed leather on the card c, Chap. II. and Plate II. be rubbed over with a very small quantity of hog's lard, or any grease, as the end of a tallow candle, &c. before fresh amalgam is spread over the said leather, it will be found to be of service towards exciting the cylinder when rubbed again with the fresh amalgam on it.

towards

towards G, the opposite conductor. This is to be understood in all cases where the cylinder is directed to be turned.

9. The cylinder A being now ready to be excited, replace the silk as directed, §. 2 and 5, and turn the cylinder A. The ball h, being screwed at the end of one of the tubes f, apply it about an inch or two from the conductor G, and strong sparks will be received on the ball. See Plate I. If every thing be dry and in order, the machine will be found greatly to exceed any electrical machine of the same size yet made.

10. The method of applying the amalgam, §. 8, must be repeatedly used whenever the electricity becomes weak; and it will be proper, when the machine is used for a considerable time at once, to take the cushion sometimes from the conductor R, and wipe the cylinder A, and wipe off any amalgam which may loosely adhere to the silk, and also the mercury of the amalgam, which often passes through the

filk, in fine particles, on to the leather of the cushion.*

11. By often rubbing the amalgamed part of the leather c against the cylinder A, the surface of the amalgam will become smooth and dry; so that, after being used some time, the glass cylinder will not be excited so strongly, when rubbed with it. In this case, a small quantity of fresh amalgam, not more than the size of half a small pea, must be taken out of the box marked *Amalgam*, and spread on the leather, and applied as before; by which means the cylinder may always be excited very strongly, and the quantity of amalgam in the box will last a long time.

* It will be found to be an advantage, sometimes to use one cushion, and sometimes the other, there being always two sent: also, turning the glass cylinder sometimes backwards, viz. the contrary way, about eight or ten times, (having first turned the filk back,) is likewise found to be of advantage towards exciting the glass cylinder; when turned again, as usual, with the filk on the glass cylinder.

12. The

12. The strength of the spark is regulated by means of the different sized balls: that is to say, if very strong sparks are required, the largest ball must be used; if rather weaker, the next smaller ones; and, if very weak, the smallest balls, or the metallic points: or if weak sparks are required from either of the balls, the *filk* of the cushion must be turned back over the conductor R, and kept there, by laying something on the upper part of the cushion.

13. If the machine is required to produce its greatest effect, it should be used in a dry warm room; for it is a fact well known to electricians, that, if the air be moist, the moisture will conduct the electricity away almost as soon as it is excited.

14. If at any time the filk K of the cushion I should be damaged, it may be easily replaced by gluing on a new one of the same dimensions in its place. Observe particularly, that the edge of the new

filk reaches within about half an inch of the points M, when laid on the cylinder. See Plate III. Fig. 2. The filk is only common black mode, about four or five shillings a yard.

15. If an accident should happen to any part of the electrical machine, it can be replaced without sending the other parts.

16. The cylinder A sometimes gets a number of little black spots, by the grease and amalgam sticking to it: this may be wiped off with a dry linen cloth or a piece of filk, first rubbing the cylinder gently, in the direction of its length, with a piece of glass paper, or a piece of fish-skin, or wiping the cylinder with a cloth dipped in soap-suds.

17. If the axis and pivot upon which the glass cylinder turns should at any time want grease, the cylinder may be taken out of its frame by unscrewing the two screws at the top of the glass pillar near the handle, with the fork and screw-driver

driver r, Plate II; and may be replaced after applying the quantity of grease required.

CHAP.

C H A P. IV.

OF THE USE AND APPLICATION OF THE
PATENT ELECTRICAL MACHINE TO
MEDICAL AND PHILOSOPHICAL PUR-
POSES.

HAVING described the electrical machine and apparatus, and also given directions for preparing the machine for use, it will now be proper to give directions for their application.

1. It is universally allowed, that the electrical fluid can be rarefied or condensed.

2. This electrical machine, therefore, may not be improperly called a machine for rarefying or condensing the electrical fluid.

3. The glass cylinder A, by rubbing against the silk K, that is between the cushion

cushion I and cylinder A, is continually depriving, not only the cushion of its electricity, but also the conductor R, connected with it. This is as constantly supplied from the earth, or common stock, by the chain b, while it hangs from the conductor R to the table. The electricity, thus drawn from the earth up the chain b to the conductor R and cushion I, is superinduced or condensed on the conductor G. If now the knuckle, or any other blunt conducting substance, be applied within the striking distance of the conductor G, then G will give or part with the electricity, superinduced or condensed on it, to the knuckle, or any other blunt conducting substance opposed to it.

4. But if the chain b is hung on the knob H of the other conductor, viz. G; then the cylinder, by rubbing against the silk, exhausting, as before, the cushion I and conductor R, carries the electricity to the conductor G. But, in this case, it is not

not superinduced or condensed on it as before; for, the chain b, hanging from G to the table, which communicates with the earth, conveys it away to the earth, or common stock, as fast as G receives it; so that G remains in its natural state, and R is exhausted more or less of its natural quantity of electricity.

Now if the knuckle, or any other blunt conducting substance, be brought within the striking distance, an electrical spark will be received from the blunt conducting substance by R, to supply what it has been deprived of; and these sparks will be continually received from the knuckle, or any blunt conducting body, brought within the striking distance, while the cylinder A is excited so as to exhaust R; for which purpose, it is always requisite that the chain b, hanging on G, should make a communication between it and the earth.

5. But if the chain b is not hung either to R or G, neither of them will have
any

any communication with the earth ; because the cylinder A, and the conductors R and G are insulated by means of the glass pillars BB and DD. Then, on turning the cylinder, the electricity will be exhausted, as before, from I and R ; and only that quantity of electricity which is contained in them, or part of that quantity, will be superinduced on G ; and this quantity, as it cannot get off from G to the earth, will be continually passing back again, either under or over the cylinder A, to that part which was exhausted of it.

6. Whence it is obvious, that this machine, to use the common mode of expression, is either a negative or positive one, and may instantly be changed from the one to the other.

7. It may also be made immediately to act on a person in the same manner as if he was electrified by two distinct electrical machines at one time, viz. with a positive and a negative one.

8. The

8. The conductor R, connected with the cushion, is that which is usually called the negative one.

9. The conductor G is commonly called the positive one.

10. If the cylinder be excited while the chain b hangs on the knob H of the conductor R, and a person applies his knuckle, or any blunt conducting body, to G, within the striking distance, he will then receive *positive sparks* on the knuckle, or conducting body, from the conductor G.

11. Or, if a person be placed on the insulated stool O, while it is connected with the conductor G, by means of the compound-joint d and the flexible joints f f f g, Plate IV. Fig. 1, any other person, standing on the ground, presenting his knuckle, or any blunt conducting body, to the person on the stool, will receive positive sparks from the insulated person.

12. But

12. But if the chain *b* be hung on the knob *H* of the conductor *G*, and a person applies his knuckle, or any blunt conducting body, near *R*, so that sparks may pass between it and the conductor, he is then *said* to receive *negative* sparks on his knuckle from the conductor *R*.

13. Or, if the compound-joint *d*, and the flexible joints *f f f g*, be applied to the conductor *R*, and connected with the insulated stool in the same manner as it was before with the conductor *G*, and the chain *b* hung on the brass knob *H* of the conductor *G*; if a person stands now on the insulated stool, and sparks pass between him and any other person standing on the ground, it is then *said*, that the person on the ground receives *negative* sparks from the person on the stool.*

14. In

* *Quærs.* Is it not that real or positive sparks pass from the knuckle, or blunt conducting body, to the conductor *R*, or the *person* standing on the insulated stool, to supply that conductor, or the person standing on

14. In the following pages, speaking of the conductors R and G, I have made use of the expressions *receiving* and *giving*, or words to that effect, instead of *negative* and *positive*. The propriety of this mode of speaking is sufficiently evident, from what has already been said in the present Chapter.

15. Plate III. Fig. 1, represents the machine with the apparatus, as in use for receiving electrical sparks from the arm, without placing the person on the electrical stool.

16. But if the electrical sparks, instead of being received *from*, are to be given *to*, the arm, then d, with the apparatus, is to be put to the conductor G, instead of R, by placing the stem of d in the hole at the top of G; and, at the same time, hanging the chain on the brass knob H, at the side of R, instead of the side of

on the stool, with the electrical fluid they have been exhausted or deprived of, by the excitation of the cylinder?

G,

G, as when sparks were to be received from the arm. It is obvious, that sparks may either be received *from*, or given *to*, any other part by this apparatus, as it may be placed, by means of the joints, in any position for that purpose.

17. Plate III. Fig. 2, represents the manner of drawing sparks *from* and giving sparks *to* the hand, exactly as if it were electrified at the same time by two distinct electrical machines, namely, what is called a positive and negative machine.

Among the many proofs of the circuit of the electric matter, an elegant one is afforded by hanging the chain on the knob H of either of the conductors in this experiment; for the passage of the electricity is immediately disturbed by the communication with the earth, and sparks pass only between the hand and the conductor, which remains insulated.

18. By this apparatus sparks may at the same time be drawn *from* any part, and given *to* any other part, without using the

C

electrical

electrical stool : as, for example, suppose them to be taken from the knee, and given to the opposite shoulder ; in this case, the ball that is connected with the conductor R must be directed to the knee, and the other to the shoulder, which is easily done by means of the joints.

The chain b must not be hung upon either conductor, when the electrical machine is intended to answer the purposes of two machines.

19. Plate III. Fig. 3, 4, is the same apparatus as in Fig. 1 ; but only represented in part, and with the conical points, instead of the ball : these are to be applied in the same manner as at Fig. 1. If the wooden conical point be used, then only the electrical aura, or wind, will be felt without any spark, and may be applied without the least inconvenience even close to the eye, as represented Fig. 3.

20. If the conical brass point be used instead of the wooden point, then the electrical aura, or wind, will be felt, if the
face,

face, or any other part, is at the distance of about five or six inches from it. If any part be brought near the conical brass point, sharp pungent sparks will be felt.

21. The conical points may also be applied and used instead of the balls in every experiment where the balls are mentioned, the screw of the conical point being the same.

22. Plate III. Fig. 5, represents the hand of a person directing the ball by means of the pliable joints and tubes *f f f*, and glass handle *K*, to his leg, in order to give electrical sparks to it; but if the tubes and joints had been connected with the other conductor, viz. *R*, then electrical sparks would have been received from the leg, instead of being given to it.

23. Plate III. Fig. 6, represents a person directing the two balls by means of the pliable joints and tubes *f f f*, and the two glass handles *k k*, in order to draw electrical sparks from one shoulder, and

at the same time give them to the other, and that without standing on the stool. These balls are readily directed to any other part, by means of the aforesaid glass handles and pliable joints.

The two sets of tubes with flexible joints may be screwed together to make a greater length, if it is required to electrify a person lying in a bed.

Plate IV. Fig. 1, shews the manner of connecting the electrical stool with either conductor, by means of the tubes f f f, with the flexible or pliable joints. Care must be taken that no part of them is near the table, by at least five or six inches.

25. The arm, represented in the Plate at Fig. 2, is supposed to be the arm of a person standing on the electrical stool, and turning the cylinder at the same time, whereby he will receive more than his natural quantity of electricity, the stool being connected with the conductor G; and when the person applies his arm
to

to the ball h, within the striking distance, he will then give to that ball the overplus of electricity he has received more than his natural quantity, by the stool on which he stands being connected with the conductor G.

26. If it is desired that weak sparks should be drawn from a person when standing on the stool, then the cord m should not be connected with the wooden clamp l, represented as fixed to a chair, Fig. 2; but if it is desired to have stronger sparks, then the brass ring of the cord m must be connected with the stem of the joint d, and the other end rest on the floor; and if very strong sparks are required, then the end, instead of resting on the floor, must be connected with metal, such as the grate, &c. in the room; and if very weak sparks, the method mentioned §. 12, Chap. III. may be used. There are other means of diminishing the quantity of electricity, which will occur to the practitioner.

27. If the stool be connected with the conductor R, and the person applies his arm as before, he will then receive a quantity of electricity from the ball h, to supply what he was deprived of by being connected with that conductor.

28. In Plate IV. Fig. 3, is shewn another method of receiving or giving sparks *from* or *to* the leg, or any other part, according to the conductor with which the stool is connected by means of the flexible joints, the person standing on the stool, and turning the cylinder at the same time. This is done by means of the glass handle k, and one of the tubes f, with the piece g, into which the short stem of k is put: one end of the cord m is screwed to the end of the tube which has the piece g, and the other part of the cord rests on the floor. If the person is unable to hold the glass handles himself, the sparks may be received *from* or given *to* him by another person standing on the floor. Here also, if strong sparks are desired,

desired, the cord must be connected with metal, such as the grate, &c. as before directed in §. 26.

29. Plate V. Fig. 1, represents the manner of giving gentle shocks through the elbow, or any other part, §. 2, Chap. VI. It is necessary, before you attempt to give the shock, to try the jar and tube, whether they are not broken. To do which, take the wire, with the ball and glass tube, out of the black-ed cork of the large jar: and wipe the uncoated part of the large jar and the glass tube clean and dry; but the large jar is not to be taken out, being fixed in the conductor. Then replace the glass tube, and put the wire with the ball into the hold in the cork, and hang one ring of the chain b on it, and the other ring put on the knob P on the board E. Then put the electrometer n, Plate II. into the hole on the top of the conductor, and slide the ball of n within a quarter of an inch to the knob H on the side of the

C 4 conductor;

conductor; and hang on the chain and wire, as represented in Plate V. Fig. 1; except this difference, that, instead of the chains being fastened to the arm, as represented, they must be made to touch one another on the table. Then, if the large jar makes a discharge between the ball of the electrometer and conductor, with a few turns of the cylinder A, it shews that jar is whole. By removing the wire with the ball from the cork into the glass tube, it may be tried in the same manner. (If either jar or tube is very damp, or has the least crack in them, there will be no discharge between the electrometer and conductor, if you turn ever so long.)

The machine being now ready for giving the shock, or vibrating motion, if smart ones are desired, the brass wire, with the ball, must remain in the hole in the cork; but, if very gentle ones, such as the most delicate constitution can bear, which is peculiar to the patent electrical machine, then the brass wire is
to

to be removed from the cork, and put into the glass tube that is fitted into the said cork ; and the communicator *u* is to be applied over the edge of the jar *S*, that one leg of it may touch the inside coating of the jar *S*, and the other leg the outside coating of the same jar ; which prevents the large jar *S* from accidentally charging by the overcharging of the small tube, Plate V. Fig. 1. It will be best that the communicator is put on that side of the jar which is farthest from the glass tube. The communicator, thus connecting with the inside and outside coating of the jar, will prevent your receiving a smart shock from the large jar *S*, when preparing for gentle ones.*

In both cases the electrometer must be regulated according to the shock or vibrating motion intended to be given ; viz.

* *Note.* When smart shocks or vibrating motions are required, the communicator is to be taken away from the jar *S*, and the wire replaced in the hole in the cork.

if

if the smartest shock or vibrating motion of either jar or tube is wanted, the ball of the electrometer must be set at the farthest striking distance from the knob H at the side of the conductor ; and, if the gentlest, the ball must be near the knob, but not touch it.

30. Plate V. Fig. 2, represents a person giving shocks along his leg ; and in the same manner he may give it through any other part and in any direction, from the head to the foot, or from the foot to the head. In this case, he must have an assistant to turn the cylinder. An assistant will likewise be required in the operation of giving and receiving sparks, as described §. 23 of this Chapter.

31. A very dense stream of electricity may be either received from, or given to, any part of the body, by means of the jars when charged.

If the dense stream is to be drawn from any part of the body, a chain must be hung from the wire, communicating with
the

the inside of the jar in the conductor R, the other end resting on the table. The chain b must be hung on the knob H of the conductor G. The jar being charged, on applying any part of the body to the conductor R, a dense stream of electricity will go from that part of the body to the conductor R.

If the dense stream is to be given to any part of the body by the conductor G, the chain that is hung on the wire of the jar in the conductor R is to be taken from thence, and hung in like manner from the wire of the jar, that is in the conductor G, to the table. The chain b is to be removed to the knob H of the conductor R. The jar being charged, the conductor G will give a dense stream of electricity to any part of the body presented to it.

If the chain, instead of touching the table, be hung, by means of its two rings, from the ball of one jar to the ball of the other, the stream will in like circumstances

cumstances be exceedingly more pungent. This dense electricity may be received from, or given to, any part of the body, by means of the apparatus already described, according as the chain b is hung on the receiving or giving conductor.

CHAP.

C H A P. V.

PHILOSOPHICAL EXPERIMENTS AND OBSERVATIONS.

1. **T**HE intention of this Treatise not being to give a detail of the experiments relating to electricity, which are already well known and amply described in other books, but rather to shew the convenience and advantage with which all experiments of this nature may be performed, by the help of the machine which is now offered to the public patronage, this Chapter will not be very diffuse and extended. For the sake of beginners, I shall cursorily enumerate the laws or leading phænomena of electricity, and subjoin a few experiments, that,
for

for their novelty, singularity, or the consequences to which they point, seem to deserve particular notice.

2. The easiest method of collecting a considerable quantity of the electric matter is by rubbing two bodies together, by which means a condensation or rarefaction of the electric matter is produced at the surface of one or both of the bodies. But it is not a matter of indifference what kind of substance is used for this purpose. Some bodies will scarcely produce electric appearances by any rubbing together, and others possess the property of becoming electrified in a surprising degree by that means. Now those bodies, which, by friction or otherwise, become electrified in such a manner, that their electric state cannot be taken off by touching a small part of their surface, are called electrics. Glass, silk, rosin, sulphur, dry vegetable fibres, and common air, are the chief specimens of this class.

3. Bodies,

3. Bodies, which, being by any means put into an electric state, are capable of losing that state by the contact of another body at a small part of their surface, are called non-electrics; or, much more properly and frequently, conductors. Metals, charcoal, animal juices, and water, are almost the only conductors we know of.

Every substance in nature is either an electric or a conductor. Since an electric cannot be deprived of its electricity at any part, without actually touching or approaching very near that part, it is evident, that the electric matter is not conveyed or conducted either through the substance or over the surface of electrics. And, since the whole electricity of a conductor may be taken away by touching any part thereof, it is likewise evident, that the electric matter does pass either through the substance or over the surface of these bodies. The internal sensation of the shock is one of the most

most obvious proofs that electricity passes through the substance of conductors.

4. The greatest quantity of electricity is collected, when a perfect electric is rubbed by a perfect conductor. But there are circumstances to be attended to, chiefly respecting the smoothness or roughness of the contiguous surfaces, which, for the sake of brevity, cannot be enumerated and described here.

5. The electricity which certain electrics acquire by friction with a conductor is obtained from the conductor; so that, if the conductor be insulated, it will likewise become electrified, by losing a part of its natural quantity, or by gaining a surplus, according as the electric body acquires what is commonly called a negative or positive state. This has been in some measure explained in Chap. IV.

6. Bodies, in like states of electricity, repel each other; bodies in opposite states attract each other; and bodies in the
mean

mean or natural state are attracted by all electrified bodies whatever.

7. If a thin electric plate, as, for example, glass, be electrified on one side, by friction or otherwise, and the other side be in contact with an uninsulated conductor, this last-mentioned side will assume a contrary electric state to that super-induced upon the former. In these circumstances the glass is said to be charged. The law of charging electrics appears to be, that the sum, or whole quantity of electricity at both surfaces, is always either accurately or nearly the same. The following experiments, made with the Patent Electrical Machine, set this important principle in an obvious point of view.

8. Experiment I. Take off the ends of the two conductors R and G, and the included jars will be visible, the wires with the balls being stuck in the cork of each. Hang the chain b on the knob H of R, and turn the cylinder. The jar

D

in

in G will not, in these circumstances, become charged, excepting by means of a small quantity of electricity, which will pass from the ball of the jar into the air. But again, if the knuckle, or any other conductor, be applied near the ball of the jar in G, during the turning, sparks will issue from it in abundance, strong and frequent at first, but gradually less and less so as the jar becomes charged. The above-mentioned jar, though insulated, being discharged, does not then appear to be in an electrical state on either side, except a small residuum, which is not carried off by the discharge.

The like experiment may be made, *mutatis mutandis*, by hanging the chain on the knob H of the conductor G.

9. Observation. Hence is deduced the consequence, that neither side of an electrical jar can be charged what is commonly called either positively or negatively, unless the other side be so situated, as to be able to assume the contrary state,
and

and that the two states are equal in intensity, because they destroy each other in the discharge.

The electricity which passes off into the air, by the ball of the jar, may, perhaps, make this consequence less evident to those who reason and think superficially. It arises from the power of the machine; and in many other common machines is scarcely perceptible. If the silk of the cushion be thrown back, much less electricity will be driven off.

10. Experiment II. Take the chain b off from H, and hang it upon the wires of the jars in R and G, by means of its two rings. Turn the cylinder about ten times. The jars will be equally charged, as appears by separately discharging them by means of a discharging-rod, viz. by placing one ball of the rod on the ball of the jar, and bringing the other near the conductor. If NAIRNE's new-invented insulated discharging-rod t, Plate II. be used, the electric fire will be seen to pass

D 2

between

between the outside and inside of the jars, when they are discharged.

11. Experiment III. Repeat the last experiment with this variation, that, instead of separately discharging the jars, apply the luminous discharger from one conductor to the other. An explosion will follow, and both jars will be at once, by that means, discharged. The iron chain, connecting the insides of the two jars, will, at the instant of discharging, be luminous; and also the inside of the luminous discharging-rod t, Plate II. will appear at the same time beautifully illuminated.

12. Observation. It is clear, from these two foregoing experiments, that two equal electrical jars may be charged without communication with the earth, by only altering the quantities of electricity at their surfaces. The machine exhausts a quantity of the natural stock of electricity from the jar in R, and throws it upon the jar in G; while an equal part of
of

of the natural stock, in the inside of the jar in G, removes by the chain to the inside of the jar in R. Thus both jars become charged, and may be separately discharged. But, if a communication be made between the outsides, the equilibrium is restored; and at the same instant the surplus, which had removed from the inside of one jar to that of the other, flies visibly along the chain to its original place. The passage of the electricity, between the two outsides, may likewise be rendered visible, if the luminous insulated discharging-rod t be made use of.

13. Experiment IV. The two foregoing experiments succeed in the same manner, when another chain is hung from one of the knobs H to the earth.

14. Experiment V. In the last experiment, if the chain, instead of communicating with the earth, be hung from the knob H to the wire of the same jar, the other jar only will be charged.

D 3

15. Obser-

15. Observation. The charging of the jar in Experiment IV. whose outside communicates with the earth, is the consequence of the alteration which the state of the insides undergoes during the charging of the other jar. The uncharged jar, in Experiment V. remains in its natural state, because its two sides communicate by means of the chain. This jar may be regarded only as an insulated conductor, which conveys the electricity from the inside of one jar to the outside of the other, and *vice versa*; and the experiment affords the same consequence with regard to a single jar, as Experiments III and IV. do with respect to two.

Experiment VI. Hang the chain from the knob H of one of the conductors, the other end resting on the table, and fit the electrometer n to the other conductor. Hang the other chain from the electrometer to the wire of the jar in the
conductor

conductor to which the electrometer is fitted. Set the ball of the electrometer within the striking distance from H, viz. about half an inch; and turn the cylinder. The electricity will be discharged visibly along the chain: but, if the ball of the electrometer be placed close to H, the jar will not become charged, and no spark will appear.

Observation. In this experiment, the jar in the first situation becomes charged, by the inside assuming, by means of the air, a state contrary to that superinduced on its outside; and the discharge shews the passage of the electricity in restoring the equilibrium. In the latter situation it is proved, that the inside, by its communication with the outside, not being allowed to assume the contrary state, the jar cannot be charged.

It is presumed that the following uncommon experiments will be acceptable to the curious.

16. Experiment VII.* To make a number of small holes in a glass tube. Stop one end of the tube with a cork, and pour a quantity of fallad-oil into it. Stop the other end with a cork, through which is previously inserted a wire, whose lower end is pointed, and bent at right angles to its length, and its upper end turned into a hook. Let the inner end of the wire be below the surface of the oil; and hang the whole apparatus upon the knob H of one of the conductors. Then, if the conductor be electrified by turning the machine, and the finger, or any other uninsulated conductor, be brought near the lower end of the wire in the tube, a spark will pass to it through the oil and glass, making a small hole. And, by turning the point of the wire to different parts of the tube, a number of holes may be struck through the same tube, so as to give it the appearance of being co-

* This experiment was communicated by the Rev. Mr. Morgan, of Norwich.

vered with stars: but the number of holes are bounded; for, if the wire is again placed too near a former hole, the electricity, finding less obstruction in passing through the hole than through the glass, of course no new hole will be made.

This experiment affords some beautiful appearances when tried in the dark, and on many accounts appears to be very fruitful in consequences.

17. Experiment VIII.* To make the soft Dutch sealing-wax assume the appearance of wool.

Take a piece of sealing-wax, about an inch long, or less, and stick one end of it on the copper ball. Screw the ball to the joint; place the stem in the hole of one of the conductors, and hang the chain on the knob H of the other. In this situa-

* This experiment occurred to me, on trying the experiments mentioned in Nicholson's Introduction to Natural Philosophy, vol. ii. page 388. All the other experiments, except Experiment VII. are original.

tion,

tion, warm the wax gently with a candle, till it is almost ready to drop. Remove the candle, and immediately excite the cylinder; at the same time holding the other copper ball, screwed to the end of the tube f, at about twelve inches distance from the wax. The electricity will immediately throw the wax upon the other ball in several very fine threads, which, being wiped off with the finger, are scarcely distinguishable from red wool.

18. Experiment IX. To cause the mercury in a thermometer to rise by means of electricity.

Take a mercurial thermometer, with a small bulb. The wooden scale must be so short, as not to reach down to the bulb by about three inches, which space will therefore be entirely clear. Prepare the machine as represented Plate III. Fig. 2, excepting that, instead of the copper balls, there must be substituted two balls of soft wood, about two inches in diameter. Suspend the thermometer so that its bulb may

may be immediately between the balls, which must not be more than half an inch asunder. Excite the cylinder, and a stream of electric matter will pass between the balls. The mercury will instantly begin and continue to rise, till it exceeds its former height very considerably. I have raised it from 67 to 99 degrees of Fahrenheit's scale. The spirit-thermometer is affected in a similar manner by the same treatment.

19. Experiment X. The spark given to a conductor, in what is called a negative state, is much more pungent than the spark received from a similar and equal conductor, in an equal positive state.

The proof of this, by the Patent Machine, is too obvious to need any particular instructions.

The different figure of the spark appears to be the proximate cause of the phenomenon. For the spark, proceeding from a positive conductor, is emitted from a single point of the surface; but, when it
has

has proceeded about one-third of its length, it becomes divided into many radiations, springing from a kind of luminous speck. It does, not, therefore, enter the hand of the observer at one, but at many points of the surface; and consequently its effects are divided and weakened. But the contrary happens when the conductor is in what is called a negative state, the ends of the spark being as it were reversed. The passage of the electricity is made through a single point, or small part of the skin of the observer, and the irritation becomes much greater.

Experiment XI. To cause the charge of three square inches and a half of coated glass to fly through the air in a dense spark of five or six inches in length.

Take off the ends, N N, of the conductors R and G. Remove the wires with the balls from out of the corks within the jars; and put them in the small coated glass tubes that are in the corks; and hang the chain b from one wire to the other,

other. Turn the cylinder; and, resting one ball of the insulated discharging-rod upon the conductor G, bring the other ball towards the conductor R. If the machine be dry and in a good state, the discharge will fly, in dense sparks of more than six inches in length, from the ball of the discharging-rod to the conductor R. But if, on the contrary, the one ball of the discharger be rested on the conductor R, and the other ball brought towards the conductor G, this last ball will draw off the electricity, (superinduced on G,) with a rustling noise, at the distance of six inches or more, and will not produce a spark till the distance is very small.

CHAP.

C H A P VI.

MEDICAL OBSERVATIONS.

I. **T**HERE can be no doubt, since the electric matter is found in all bodies, but that it is an universal and principal agent in the system of the world. Much remains to reward the assiduity of future discoverers. Electricity is yet in its infancy ; but, like the other branches of philosophy, its infancy has been embarrassed by a number of theories, contrived by men who prefer the effusions of fancy to the slow though sure method of experiment and observation. General inferences, drawn from experiments which were either few, inaccurate, or false, have, in many instances, disgraced the sciences. The influence of electricity on the animal frame has never been disputed ; but the success of its application to the cure
of

of disorders has been exceedingly magnified by some writers, and as much slighted by others. The common source of both these opposite opinions may be attributed to the superficial observations of those who held them. But it is now established from a multitude of facts, that electricity is almost a specific in some disorders, and deserves to be held in the highest estimation for its efficacy in many others. It is not intended in this short treatise to give any circumstantial account of the cases upon which the following part of this chapter is grounded; but the reader may depend upon it, that it contains not a single assertion which has not been confirmed either by the author's own experience, or the testimony of a numerous acquaintance of ingenious and worthy men, who are ready to promote any undertaking which is intended to advance the public good.

2. The early method of applying electricity consisted in giving large shocks
from

from jars of very considerable magnitude. (See Note on §. 3.) This practice is at present discontinued; and an opinion seems to prevail, that the gentler methods of simple electrization, such as receiving or giving the electric aura or wind by wooden or metallic points, and also the sparks either on the ground or electrical stool, as circumstances may require, are sufficient in most cases in which electricity can be used with advantage. It is difficult for one who thinks he has made a discovery, to avoid running into extremes; and, perhaps, upon reflection, we shall not find reason entirely to exculpate those who so strenuously recommend those very gentle methods. It is certain, that the administering of shocks has done service in cases in which simple electrization has not been found effectual; and therefore it would be injudicious to attempt to establish any general rule for excluding them. The best method seems to begin with simple electrization, and to
 proceed

proceed gradually, as may be thought necessary, either to receive or give the electric matter by metallic or wooden points; or the sparks, by rubbing a metallic ball quickly backwards and forwards over a part of the body covered with a woollen cloth; to receive or give sparks of different sizes, when either placed on the stool, or standing on the ground, as directed, §. 12, Chap. III. or §. 28, Chap. IV. to draw the dense stream as directed, §. 31, Chap. IV. or to give gentle shocks, which may be either general, or confined to a particular part, as described, §. 29 and §. 30, Chap. IV. A little experience will enable the operator to judge the proper degree of electricity; and the Patent Machine is peculiarly applicable to every known method of applying it.

3. The opinions of the Faculty are divided concerning the mode of action which electricity exerts on the human frame. By some it is thought to relax
 E universally,

universally, and by others to be stimulant and bracing. Both opinions seem to agree with the facts. Electricity, applied in the gentlest manner, appears to be sedative and relaxing; and in the stronger methods it may naturally be supposed to stimulate.* But it is an advantage, that we are not under the necessity of waiting till a theory is established, before we can receive benefit from the powerful, though safe, application of electricity.

4. The very many cures performed by electricity in the hands even of persons entirely unskilled in medicine, and its never having produced any ill effects when applied with moderate degree of force, give it an advantage, which, perhaps, no other remedy is entitled to claim. It may

* *Note.* Those, whose case may require rather strong shocks, may remove every fear they have of being injured by them; the Patent Electrical Machine being so constructed, that the strongest shock that can be administered by it can no way detriment the most delicate constitutions.

be

be laid down as an established fact, that electricity, judiciously applied, has never done hurt. A healthy fibre is never injured by it: it may consequently be conveyed without any difficulty or apprehension to the seat of any local disorder, as it may be passed, without any diminution of its virtue, through the intervening sound parts.

5. Simple electrization, or standing on the stool, is affirmed to increase the circulation of the blood, and promotes glandular secretion.

6. The various applications of electricity are particularly serviceable in obstructions. In many disorders, whose remote causes are of this nature, its action and effects are beyond expectation. The suppression of the catamenia and all its consequent evils are removed to almost an absolute certainty, by passing the electric matter through the region of the pelvis. Very many instances of patients relieved from the most hopeless situation conspire

to recommend this remedy as specific in such cases; and the advantages mankind may reap from it are so much the more valuable, as the *Materia Medica* furnishes us with few medicines at all adequate to the purpose. The method of administering electricity for these disorders is to place the patient between the two balls h h, Fig. II. Plate III. placed on opposite sides of the waist; and accordingly as the sensation is more or less disagreeable, the balls must be removed nearer to or farther from the body. In some instances, the points may be substituted instead of the balls. Care must be taken to be assured, that the patient is not pregnant; and the electricity should rather be too weak than too strong, for fear of producing an immoderate flow.

7. Nervous disorders, in general, give way to gentle electrization, but are sometimes aggravated by the application of too great a force. Nervous head-aches are often mitigated and entirely relieved by the

the electric wind from a metallic or wooden point, applied at a distance opposite the temples, and successively round the head. The effects of too much irritation are so exceedingly disagreeable, that great attention must be had to make trial first of the mildest methods.

8. In recent bruises, burns, scalds, or any other local pain of no long standing, numberless instances establish the immediate efficacy of electricity. The electric wind or sparks may be used in these cases.

9. The natural secretions are promoted by electricity, and those which are adventitious or unnatural are retarded, and often suppressed. The latter effect seems to be a consequence of the former; for most unnatural discharges are caused by the obstruction of some natural secretion or circulation which ought to have been performed. Thus the proximate cause of the purulent discharges of ulcers, &c. is either the stoppage of the circulation or

the perspiration of the part, whose vessels are inflamed or obstructed; and if electricity be possessed of power to promote a proper circulation through the finer passages, the vicious discharge must cease of course. It seems to be a good method, in superficial complaints, to administer the aura or sparks; but in disorders, which principally affect the interior part of the body, gentle shocks are to be preferred.

10. Blood-shot and other inflammations of the eyes are almost always cured by the electric wind. The fistula lachrymalis has been cured, in many instances, by the same treatment. And there are not a few remarkable cases, in which blindness, whether arising from an opacity in the cornea, or the insensibility of the retina, has been removed by electricity, applied either in the form of wind or sparks to the eye itself, or shocks passed near the eye. But it must be confessed, that it has failed in many other instances of this last kind.

11. The

11. The tooth-ache, arising from cold, is generally cured by drawing the sparks from the outside of the face opposite the tooth. A shock properly directed through a tooth beginning to decay frequently takes away the pain, by destroying the sensibility of the end of the nerve.

12. The sore-throat is very often cured by drawing sparks ; and the same method is frequently successful in dispelling glandular tumours, even of the greatest magnitude. Generally speaking, all swellings, which do not contain matter, are dispersed by electricity ; and those which do are benefited by it. Cutaneous eruptions are often cured by the electric wind.

13. Deafness from cold, from too much wax, or proceeding from a fever, seldom fails of being removed by the electric aura, by drawing sparks or by gentle shocks from one ear to the other.

14. Sprains, cramps, contractions, among which the locked-jaw stands con-

firmed by many successful cases, and few to the contrary; rheumatic pains, whether local or otherwise, are all peculiarly within the province of the electrical operator, as they have been constantly removed with scarcely any exception. The method is, to use repeated gentle shocks through the part affected, and increase the force till success attends: but in these, as in all other cases, the feeling of the patient must be consulted; for shocks, that have been given from very large jars, have been frequently found to be very disagreeable, without being effective: but such attention has been paid in the construction of the Patent Electrical Machine, that the strongest shocks requisite for any disorder may be given, by this machine, without any danger to the person requiring them.

15. The sciatica, the proper gout, and the palsy, have been often cured by electricity, applied according to the various degrees. The first of these disorders is
much

much more capable of relief from electrical treatment than the other two. It is thought by some, that there is danger of repelling the morbid matter of the gout from the extremities to the nobler parts; but this opinion does not seem to have any solid foundation. In recent palsies, much good has been done, even on patients far advanced in years; but palsies of long standing, though relieved at first, are seldom effectually cured. The most judicious method appears to be that of first drawing sparks from the diseased part, and afterwards to give shocks confined to the part, rather strong at first, but weaker as the sense becomes more acute.

16. Considerable cures have been performed by electricity in epileptic and hysterical cases. A few gentle shocks, administered during the fit from arm to arm through the chest, almost infallibly remove these disorders; and a daily continuation of the remedy for some days after has prevented the return in many cases in which

which the disorder had long been habitual. When the period is known, or the approach of a fit can be predicted, a few gentle shocks may, perhaps, avert the evil.

17. Agues are cured by administering shocks through the chest and sides, or cross-ways, from each hand to the opposite foot, just before the fit is expected. This disorder is commonly cured by a very few times electrifying.

18. The Patent Electrical Machine is superior to others, by the means it affords of trying the medical effects of electricity, as you may either give it to any part of the body, and at the same instant receive it from any other part. See §. 17, 23, Chap. IV. and Plate III. fig. 2, 6; and if the insulated stool O be connected with the conductor R, by means of the metallic tubes f f f, and compound joint d, a person standing on the stool, and touching the conductor G, may make the electrical fluid to circulate through him, or any
part

part of him, as long as he pleaseth; previous care being taken that the chain b is removed from either of the conductors, and that the metallic tubes touch not the table. And, if connected only with the conductor R, the chain b being hung on the brass knob H of the conductor G, he may keep himself in an exhausted state of electricity; and *vice versa*, being connected only with the conductor G, and the chain removed to the brass knob H of the conductor R, he may keep himself in a condensed state of electricity. See Fig. 1, Plate IV.

19. The very sudden cures which are daily performed by electricity, and the exaggeration which is made in relating facts by those who are fond of the marvellous, have led many patients into an expectation, that their disorders will vanish as it were by enchantment, when they are electrified. It is not enough for these mistaken people to be informed, that electricity, both for its universality
and

and efficacy, deserves to stand first in the list of remedies; but they require it to work miracles. For this reason, and to prevent the discouragement which the disappointment of their unreasonable expectations may cause, it is necessary to observe, that instantaneous relief must not always be expected; and that several disorders, which were not sensibly affected by a month or more electrization, have in time been cured by persevering in the use of the remedy. It is probable, that many of the cases in which electricity has failed would have been crowned with success, if the opinion of its inefficacy had not been too hastily adopted.

20. The reader, who may be inclined to think the assertions contained in this chapter stand in need of the support of the facts, is referred to the Philosophical Transactions; Becket's Essay on Electricity; Cavallo's Essay on the Theory and Practice of Medical Electricity; Birch's Considerations on the Efficacy of Electricity

city in removing Female Obstructions; New Thoughts on Medical Electricity, or an Attempt to discover the real Uses of Electricity in Medicine; Symes's Fire analysed; Lovett's Subtil Medium proved; and Wesley's Desideratum; in all which he will find a variety of well-attested cases.

The following fact came to my knowledge since the foregoing sheets went to the press; it seems well worth the practitioner's notice, for the benefit of society. A friend of mine, an elderly man, of great respectability, at Nottingham, laboured under very severe indisposition, so much so as his life was in extreme danger. He was attended by two physicians of great eminence; his complaint was a very violent sickness at the stomach, which refused all nourishment as well as medicine, attended with a complete obstruction, which reduced him from a very corpulent man to a mere skeleton. Fourteen ounces of quicksilver were given him,
and

and remained upwards of fixty hours without producing any effect but an increased vomiting and visible decay. In this melancholy and perilous situation, electricity was tried as the last resource, and administered by passing smart shocks through the region of the stomach, which had so great an effect, as to remove what was considered by the physicians to have been the cause of the complaint, viz. a thickish tough phlegm of a weighty kind, resembling matter. Soon after the removal of which, he was able to take nourishment and medicine, and continued hourly to amend when the account was transmitted to me.

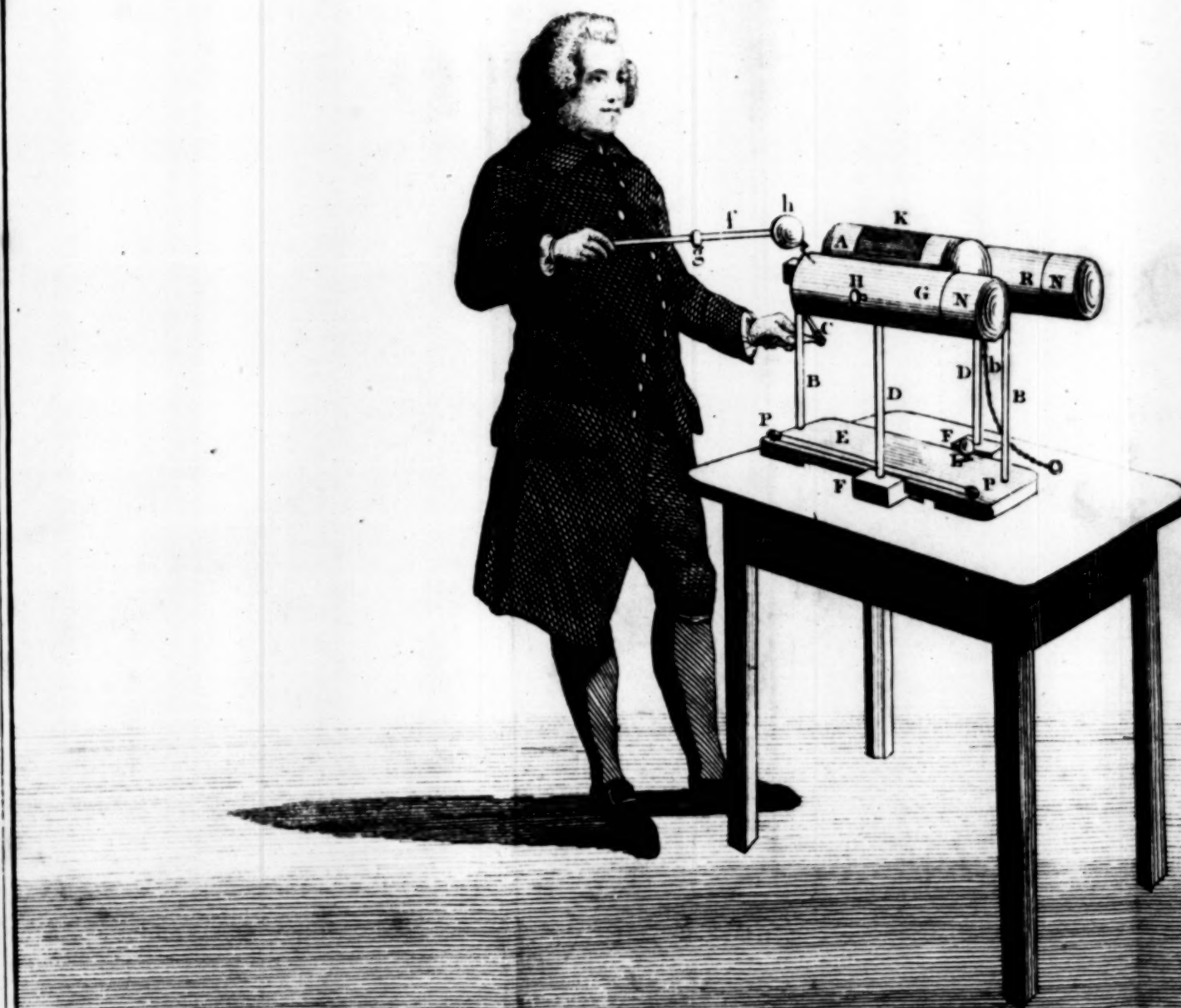
N. B. He received twelve shocks night and morning for several days after the removal of the complaint, which appeared greatly to assist his recovery.

*** The number of applications which have been made to Mr. NAIRNE, by patients desirous of receiving the benefit of medical

medical electricity, renders it necessary for him respectfully to inform the public, that his other avocations make it impossible for him to attend to any applications of that nature.

When leisure permits, Mr. N. proposes to publish some papers on electricity, formerly communicated by him to the Royal Society, and which have been since printed in the Philosophical Transactions. The references are as follow: Experiments on metals, animals, and vegetables, Vol. 64; on the advantage of elevated pointed conductors, Vol. 68; on the effect of electricity in shortening wire, Vol. 70; an account of the same effect produced by lightning, Vol. 72.

THE END.



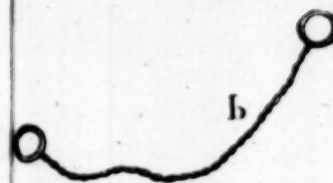
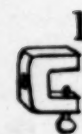
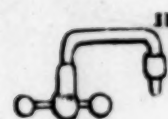
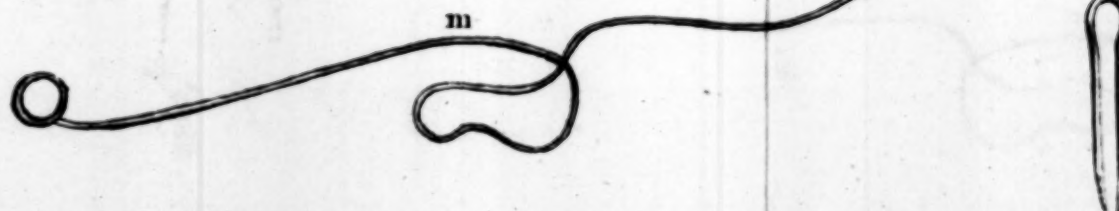
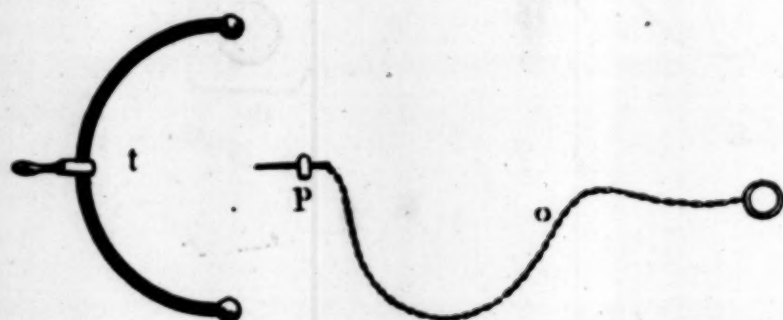
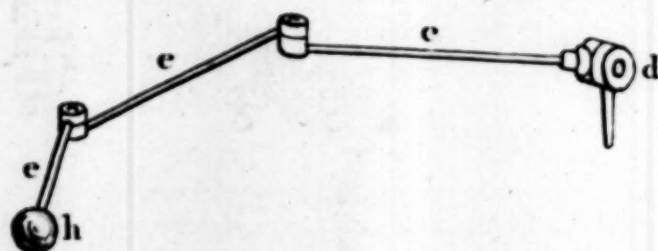


Fig. 2.

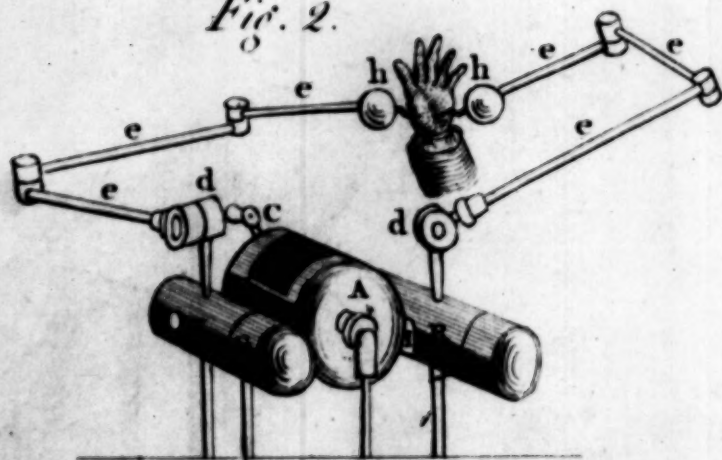


Fig. 3.

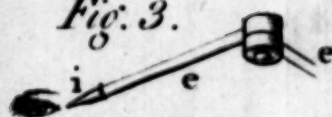


Fig. 1.

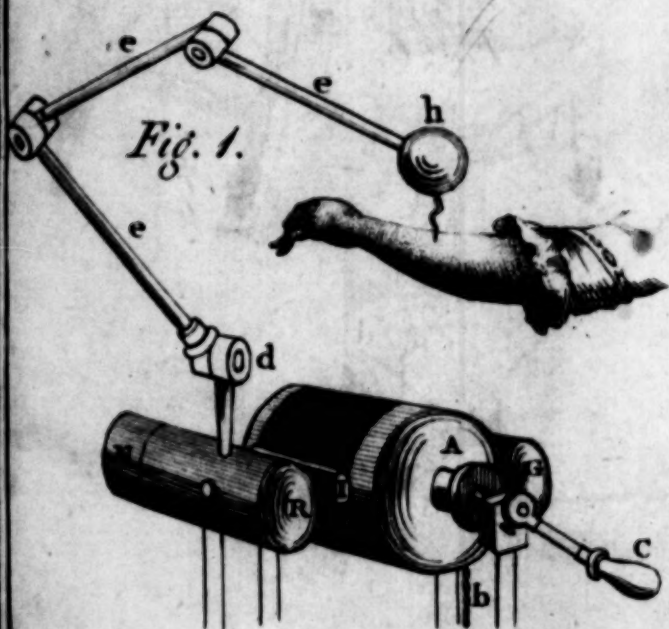


Fig. 4.



Fig. 5.

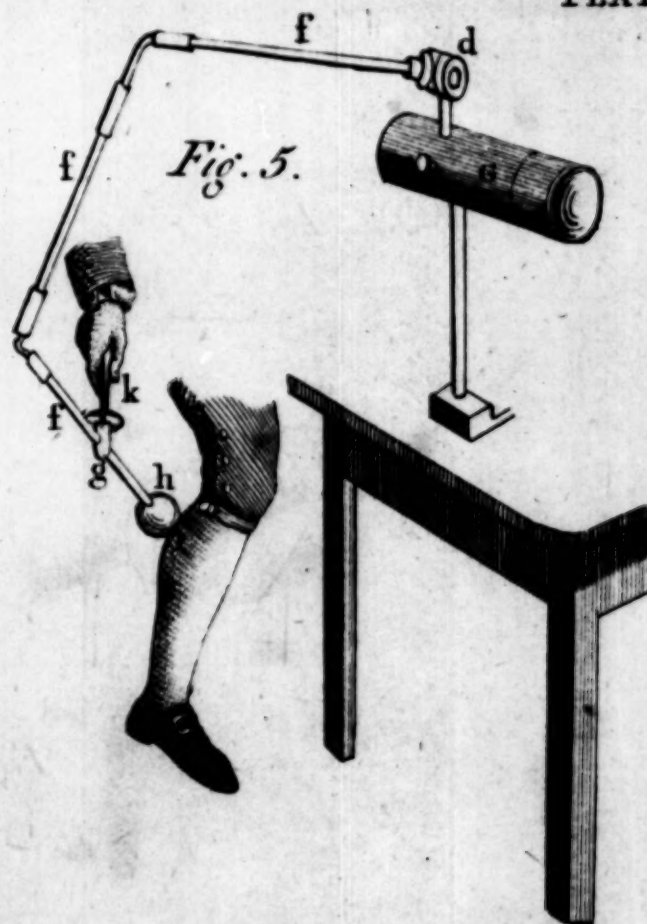


Fig. 6.

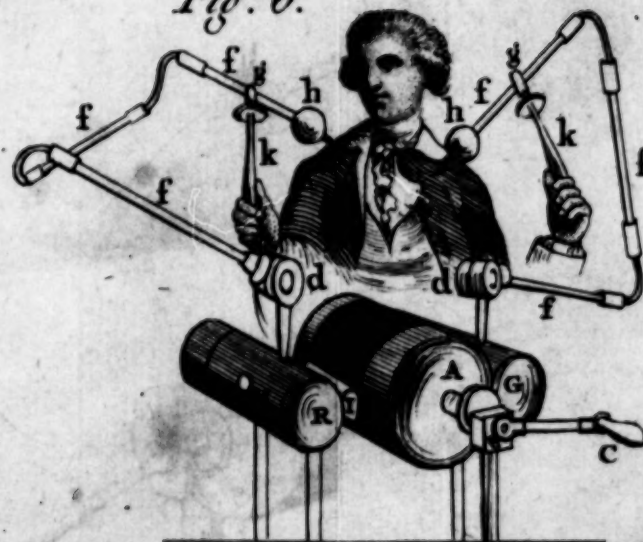


Fig. 2.

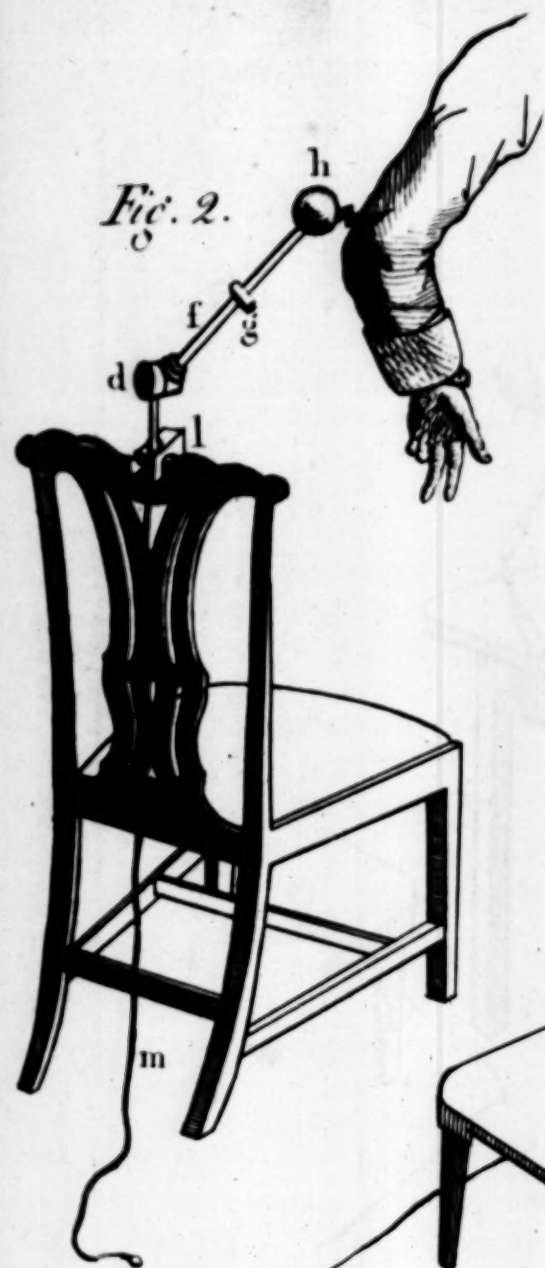


Fig. 1.

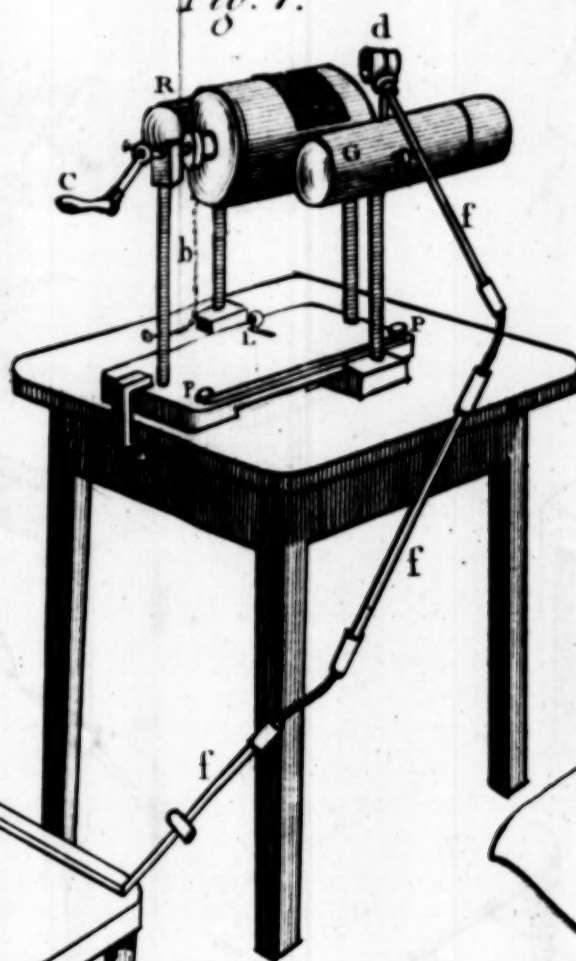
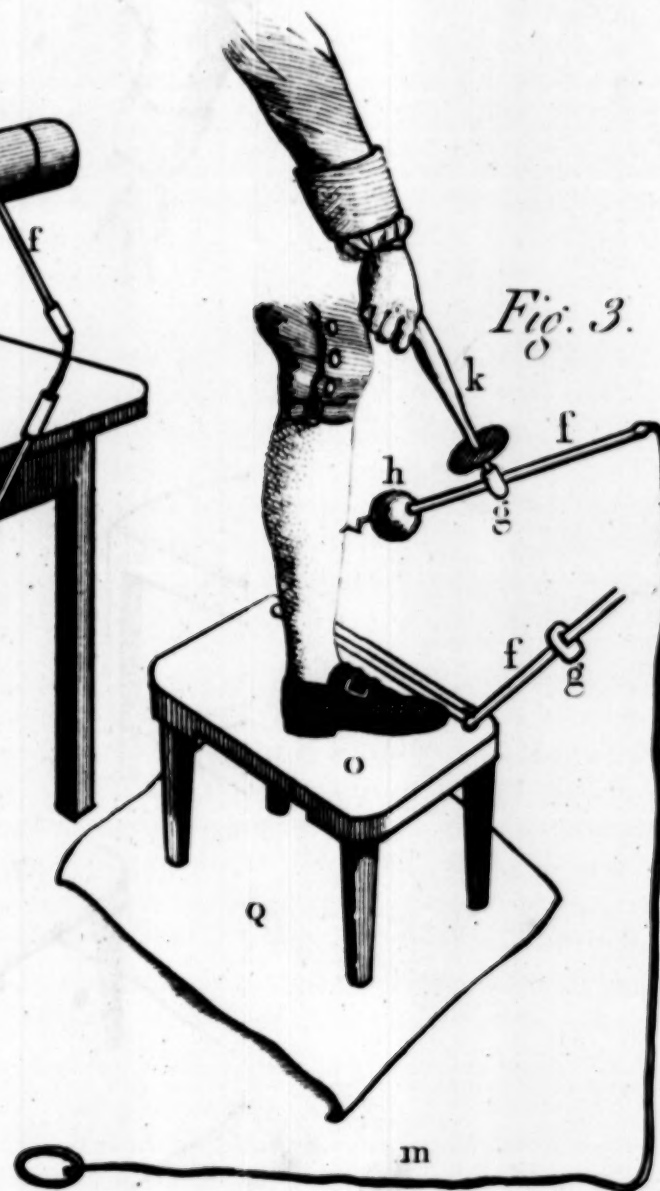
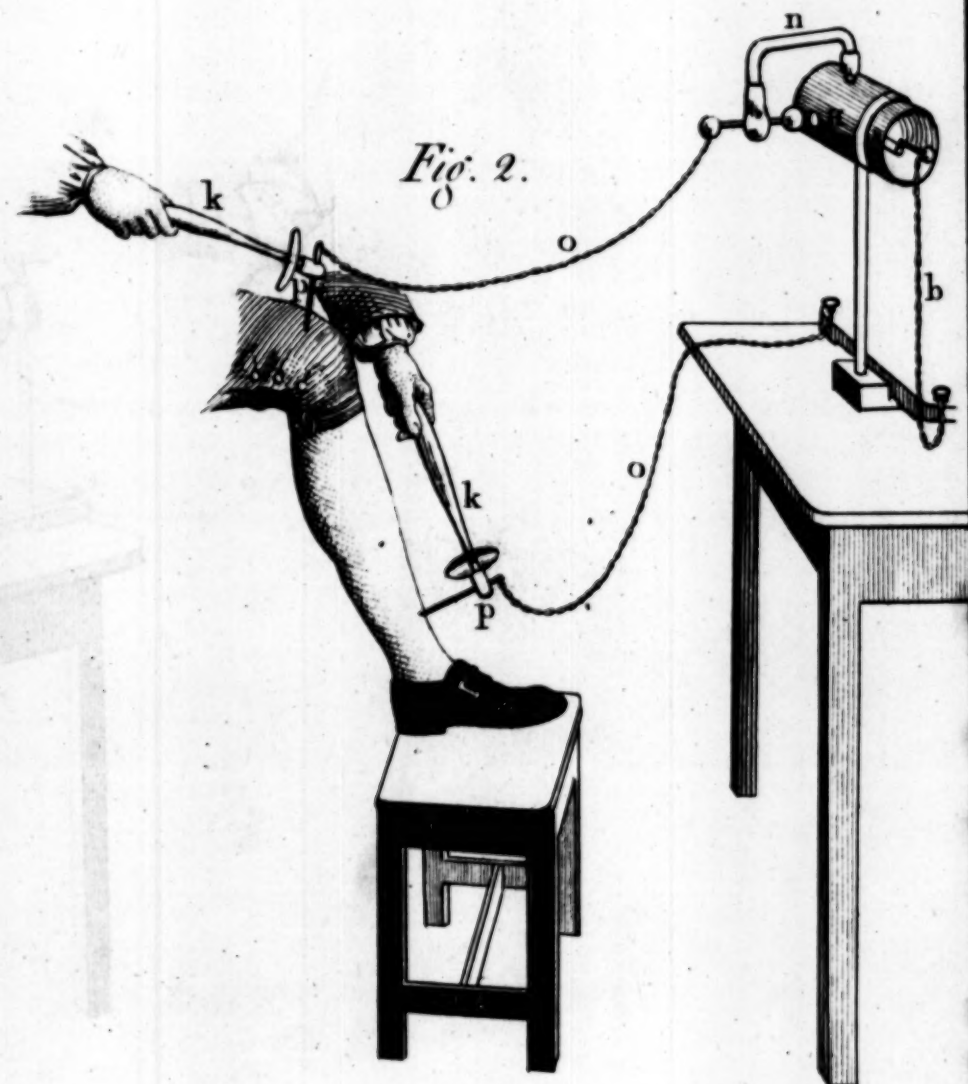
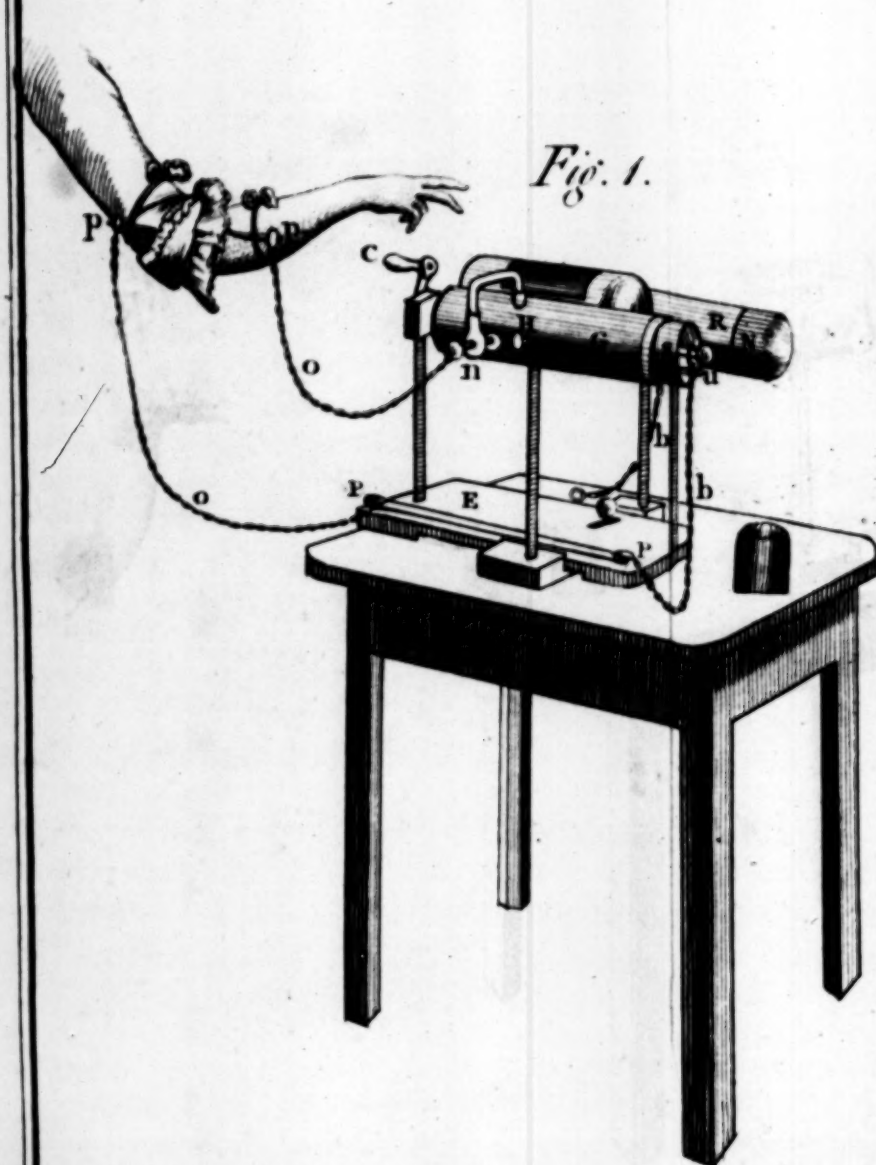


Fig. 3.





P R I C E S
OF
NAIRNE'S
Patent Electrical Machines,
AND A
CATALOGUE
OF SOME OF THE VARIOUS OPTICAL, MATHEMATICAL,
AND PHILOSOPHICAL, INSTRUMENTS,

MADE AND SOLD BY
EDWARD NAIRNE,
No. 20, CORNHILL, opposite the ROYAL-EXCHANGE,
LONDON.

Electrical Instruments.

	£. s. d.
A Patent Medico-Electrical Machine, Cylinder about five Inches Diameter, with Medical Apparatus, and Amalgam in a coloured Deal Box	5 15 6
A Patent Medico-Electrical Machine, Cylinder about seven Inches Diameter, with Medical Apparatus, and Amalgam in a coloured Deal Box	7 17 6
Ditto, ditto, as above, with more complete Medical Apparatus	10 10 0
Ditto, ditto, as above, with complete Medical Apparatus	12 12 0
F	Although

Although the above Machines are constructed for medical Purposes, they are EQUALLY APPLICABLE TO PHILOSOPHICAL Uses, and will be found to produce a greater Quantity of Electric Fire than any Machine of the same Size hitherto made; and have also sufficient Strength for any medical Purpose whatever.

They have likewise this superior Advantage, in answering the Purpose of a Person being electrified at the same Time with two electrical Machines; for, while these draw the electric Fluid from one Part of the Body, they will give it to any other Part desired.

	£. s. d.	£. s. d.
Electrical Machines without Apparatus		4 4 0
Patent Electrical Machines on a larger Scale than those before-mentioned, from	16 16 0 to	160 0 0
Electrical Batteries, from	2 12 6 to	100 0 0
Electrical Jars, from	0 5 0 to	0 10 6
Directors with Glass Handles, Diamonded Jar		0 10 6
Belted Jar, or Analysis of the Leyden Phial		0 18 0
Double Jar		0 16 0
Magical Picture		0 10 6
Nairne's Luminous Discharging-Rod		0 7 6
Insulated jointed Discharging-Rod		0 10 6
Universal Discharger and Press, Kinnersley's Electrical Thermometer		1 11 6
Lane's Electrometer and Jar		1 1 0
Quadrant-Electrometer		1 4 0
Bennet's gold-leaf Electrometer in a mahogany Box		0 7 6
Cavallo's Electrometer		0 15 0
Cavallo's atmospheric Electrometer, from		0 10 6
Cavallo's Multiplier, a new and excellent Instrument	0 10 6 to	1 1 0
		1 6 0
		Nicholson's

	£. s. d.	£. s. d.
Nicholson's revolving Doubler		3 3 0
A Thunder-House		0 5 0
Ditto, with a Drawer		0 7 6
A Pyramid		0 12 0
A Powder-Magazine		0 15 0
A Boat with glass Mists		0 16 0
A Set of Bells		0 7 6
A Set of Bells mounted on a Stand		1 1 0
A Set of musical Bells		1 11 6
Electrical Sportsman		2 12 6
Plates and Images		0 5 0
Jar and artificial Spider		0 12 0
A Head with Hair		
Luminous Conductors, from	1 1 0 to	1 16 0
Exhausted Flask, or Aurora Bo-		
realis		0 10 6
Spiral luminous Tubes		0 7 6
Set of Spirals with a Flyer		1 16 0
Luminous Words, from	0 16 0 to	1 11 6
Electrical Star		1 1 0
Electrical Planetarium,		
with glass Balls,		3 3 0
Electrical Orrery,	to be set in Motion by electric Fluid,	0 16 0
A Set of paper Models,		3 3 0
Flyer and Feathers,		0 4 6
Electrical Mortar		0 4 6
Electrical Cannon for Gun-		
powder	0 5 0 to	1 11 6
Electrical Pistols,		0 7 6
Ditto, mounted, in Sets,	for inflammable Air,	
Volta's Electrical Lamp,		3 3 0
Electrophorus, from	0 7 6 to	4 4 0
Balls of different Materials, to produce various coloured Sparks		
Insulated Stools, from	0 12 0 to	1 11 6
Conductors for Ships, to pre- serve them from the dange- rous Effects of Lightning, according to the Length	3 3 0 to	9 9 0
	F 2	Ditto,

	£. s. d.	£. s. d.
Ditto, for Buildings - -		2 12 6
Also all the different Electrical Apparatus, either for Amusement or philosophical Uses, hitherto known.		

Optical Instruments.

Best double-jointed silver Spectacles with Glasses -		1 1 0
Ditto, with Brazil Pebbles -		1 16 0
Ditto single-jointed ditto, with ditto -		1 10 0
Ditto, ditto, with Glasses -		0 15 0
Also gold and silver-gilt Spectacles.		
Best double-jointed steel Spectacles with Glasses -		0 9 0
Another Sort of ditto -		0 7 6
Best single-jointed steel Spectacles -		0 5 0
Second Sort ditto -		0 2 6
Tortoiseshell Temple-Spectacles -		0 10 6
Ditto double-jointed ditto -		0 16 0
Spectacle-Cases, from -	0 1 6 to	1 4 0
Nose-Spectacles mounted in Silver -		0 7 6
Ditto, in Tortoiseshell and Silver -		0 3 6
Ditto, in Horn and Steel -		0 1 6
Hand-Spectacles, Horn or Tortoiseshell, from -	0 7 6 to	0 10 6
Ditto, Tortoiseshell and Silver, or Pearl and Silver, from -	1 8 0 to	1 11 6
Spectacles with green Glasses, Also green Shades for weak Eyes.		

Spectacles

	£. s. d.	£. s. d.
Spectacles for couched Eyes -		
Concave-Glasses in horn Boxes for near-sighted Eyes -		0 1 6
Ditto, in Tortoiseshell -		0 3 6
Ditto, mounted in Tortoise- shell and Silver, Pearl and Silver, &c. from - -	0 10 6 to	2 2 0
Reading-Glasses - -	0 3 6 to	1 11 6
Burning-Glasses - -	0 4 6 to	
Watch-Makers' Glasses -		0 1 6
Concave and Convex Mirrors in Frames - -	0 7 6 to	50 0 0
Cylindrical ditto, ditto -	1 1 0 to	13 13 0
Opera-Glasses - -	0 7 6 to	1 1 0
Ditto, Ivory, two gilt Drawers	1 16 0 to	2 2 0
Ditto, Silver mounted -	1 11 6 to	4 4 0
Ditto, in Gold - -		
Diagonal Opera-Glasses -	1 1 0 to	

Common Refracting Telescopes	0 10 6 to	1 11 6
Night ditto, for Sea - -		2 2 0
Achromatic Telescopes for Na- val Use of 1, 2, 3, and 4, Feet long, from - -	1 5 0 to	12 12 0
Ditto two-feet, for Day and Night - - -		5 5 0
An Achromatic Telescope, a- bout thirty Inches long, on a brass Stand, with different Sets of Eye-Glasses for view- ing terrestrial and celestial Objects, in a neat portable mahogany Box. — This Te- lescope is the most useful for general Purposes - -		10 10 0
The above, with Rack-Work, &c. - - -		15 15 0
An Achromatic Telescope, a- bout three Feet and a Half		

	L. s. d.	L. s. d.
long, on a plain brass Stand, with different Eye-Pieces. — This is serviceable for astronomical Purposes -		18 18 0
The above, with additional Powers and Rack-Work, complete - - -		26 5 0
Also all the various Sorts of Achromatic Telescopes, par- ticularly those of 1, 2, and 3, Feet long, with brass Drawers, which shut up commodiously for the Poc- ket, from - - -	1 16 0 to	5 5 0
Ditto, elegantly mounted, with gold or silver Drawers -		
Ditto, gilt or plated - -		
Clips and Screws, serving the Purpose of a Stand for the Pocket - Telescopes, very portable and convenient -	0 10 6 to	0 15 0
Achromatic Perspective-Glasses Reflecting Telescopes, six Feet long, with Rack-Work, on Mahogany Stands -	105 0 0 to	150 0 0
Ditto, four Feet long, with ditto	78 15 0 to	100 0 0
Ditto, three Feet long, with ditto, or on Brass Stand -	36 15 0 to	56 0 0
Ditto, two Feet long, on Brass Stand - - -	12 12 0 to	21 0 0
Ditto, eighteen Inches long, ditto - - -		8 8 0
Ditto, twelve Inches long, ditto		5 5 0
Micrometers of different Kinds.		

Compound or Double Reflec- ting Microscopes - -	3 3 0 to	7 17 6
Solar Microscopes, with com- plete Pocket-Microscope -		5 5 0
		Lucerna]

£. s. d.

£. s. d.

Lucernal Microscopes, complete for opaque and transparent Objects; it does not fa- tigue the Eye, and is a sub- stitute for the Solar Micro- scope, and, in some Points, superior to it						21	0	0	
An universal Microscope, com- prehending Compound, Sin- gle, Solar, Opaque, Aqua- tic, and Botanic, in a Case complete						21	0	0	
Opaque Microscopes	-	-	2	2	0	to	3	3	0
Aquatic or Elis's ditto	-	-					3	13	6
Small Botanic and Pocket Mi- croscopes, from	-	-	0	6	0	to	2	2	0
Camera Obscuras, from	-	-	0	16	0	to	7	17	6
Optical Machines for viewing perspective Prints	-	-					0	18	0
Improved ditto ditto, enclosed							2	12	6
Scioptic Balls and Sockets	-	-					0	10	6
Glass Prisms	-	-	0	7	6	to	2	2	0
Magic Lanterns	-	-	1	1	0	to	2	2	0
Paintings for ditto, each Slider							0	5	0
Metal Cylindrical Mirror, and a Set of distorted Prints	-	-					2	2	0
Polyhedrons or Enigmatical Machine and Prints	-	-					3	3	0
Optical Deception, making the Reflection of Objects appear to advance and seem tangi- ble	-	-							
Magnifying-Glasses for Bota- nical, Anatomical, and other Purposes	-	-	0	2	0	to	1	11	6

Geographical and Astronomical Instruments.

			£. s. d.		
A Pair of Globes					
28	Inches Diameter	in mahogany Frames - -	50	0	0
28	ditto	in Frames carved and orna- mented - -			
28	ditto	mounted in a common Man- ner - -	35	0	0
18	ditto	best Manner, carved Frames	16	16	0
18	ditto	in mahogany Frames - -	12	12	0
18	ditto	best Manner, stained Frames	10	10	0
18	ditto	common Manner -	6	6	0
12	ditto	best Manner, mahogany Frames - -			
12	ditto	ditto, stained Frames -	5	15	6
12	ditto	common Manner - -	3	3	0
9	ditto	best Manner - -	4	4	0
9	ditto	common Manner - -	2	2	0
6	ditto	best Manner - -	3	3	0
6	ditto	common Manner - -	1	16	0
3	ditto	mounted - -	1	11	6
3	ditto	in fish-skin Cases for the Pocket - -	0	10	6
A Meridian Telescope or Transit Instrument, with Stand and Apparatus com- plete, very good and use- ful - -			42	0	
Nairne's complete Equatorial Instrument, or portable Ob- servatory, as described in Vol. LXI. of the Philoso- phical Transactions, with later Improvements - -			80	0	0
Astronomical Quadrants -			Equatorial		

	£. s. d.			£. s. d.		
Equatorial Telescopes, viz. with divided Circles, Polar Axis, &c.	-	-	-			
Circular Instruments	12	12	0	to		
Horizontal Sun-Dials, from	0	10	6	to	8	8
Universal Ring-Dials, from	0	7	6	to	21	0
Armillary-Spheres	-	-	-			
Astrolabes	-	-	-			
Also Planetariums, Telluri- ans, Lunariums, Cometa- rium, Orreries, &c.						

Mathematical, Surveying, Navigation, and Military, Instruments.

Plain Compasses for measuring Lines	0	1	6	to	0	5	0
Large ditto	-	-	-				
Drawing-Pens	0	1	6	to	0	5	0
Bow-Compasses for describing small Circles	0	3	0	to	0	5	0
Hair-Compasses for measuring Lines with great Accuracy					0	7	6
Beam-Compasses for drawing large Circles, marking off Divisions, &c.	1	16	0	to			
Triangular Compasses for trans- ferring Three Points at once	0	12	0	to			
Proportional Compasses	1	11	6	to			
Elliptical Compasses	-	-	-				
Rolling Parallel Rules	-	-	-				
Parallel Rules cross-barred, three-barred, and plain. — Sectors, Protractors, and Scales, in Brass, Ivory, and Box-Wood	-	-	-				

Protractors,

	<i>£. s. d.</i>	<i>£. s. d.</i>
Protractors, square, circular, and semicircular - -		
Ditto with moveable Limbs and Vernier - -		
Pocket-Cases of Drawing-In- struments - -	0 7 6 to	6 16 6
Magazine, or complete Set of Drawing-Instruments - -	10 10 0 to	30 0 0
Ditto, the Instruments Silver - Pentagraphs for reducing, en- larging, or copying, Draw- ings - -	2 12 6 to	5 5 0
Instruments for Drawings in Perspective - -		
Plotting-Scales - -		
Ivory and Box-wood Rules of all Sorts, also Gauging-Rods.		
Perambulators, or Measuring- Wheels - -	6 16 6 to	10 10 0
Tape-Boxes, different Lengths		
Measuring-Chains, ditto - -		0 7 6
Gunter's Chain - -		6 16 6
Plane Tables - -	4 14 6 to	11 11 0
Theodolites - -	5 5 0 to	31 10 0
Ditto, better and best Sort - -	18 18 0 to	4 14 6
Circumferentors - -	2 2 0 to	11 11 0
Levelling-Instruments, with Sights only or with Tele- scope, &c. - -	2 12 6 to	1 16 0
Station-Staves - -		7 7 0
Miners' Compasses - -	0 10 6 to	6 6 0
Hadley's Quadrants, Mahoga- ny or Ebony - -	1 16 0 to	15 15 0
Sextants, in Wood or Brass - -	6 16 6 to	
Artificial Horizons, various Kinds - -		
Magellan's Circular Instru- ments, to answer the Purpose of a Sextant - -	12 12 0 to	
Gunter's Scales - -	0 2 0 to	0 3 6
Improved Sliding ditto, with Book - -		0 18 0
		Ditto,

	£.	s.	d.	£.	s.	d.
Ditto, with Adjusting-Screw -				1	4	0
Knight's Azimuth-Compasses -				5	15	6
Ditto, with three-legged Staffs				6	16	6
Cabin, Steering, and Amplitude, Compasses, all Sizes and Prices.						
Binnacle-Lamps - - -						
Hour-Glasses - - -						
Nairne's Marine Barometers.						
By these, Storms have been foretold at Sea - -				10	10	0
Gunner's Levels, Callipers, Gauges, and Quadrants.						

Meteorological, Philosophical, and Magnetical, Instruments.

Plain Portable Barometers	-					2	2	0
Neater mounted ditto	-	2	12	6	to	2	16	0
Barometer, with Thermometer, Glas Doors	-					4	4	0
Ditto, ditto, with a Float, Rack-work, &c.	-	6	6	0	to			
Ditto, ditto, and Hygrometer								
Ditto, to measure the Height of Mountains	-							
Marine-Barometers	-					10	10	0
Diagonal Wheel and Statical Barometers	-							
Thermometers, Fahrenheit's or Reaumur's Scales	-	0	10	6	to	3	3	0
Ditto, Botanic	-					1	1	0
Ditto, for Brewers	-	0	12	0	to			
Hygrometers, De Luc's	-							
Ditto, Oat Beard and others	-							
Pluviometers, or Rain-Gauges								
Wind-Gauges	-							
Eudiometers	-							
Pyrometers	-							

Double-

	£. s. d.	£. s. d.
Double-barrelled small Table Air-Pump - - -		6 6 0
Ditto large ditto - - -		12 12 0
Large standing Air-Pump, on Smeaton's Construction, with Additions for very near Exhaustion - - -		30 0 0
A most capital large Air-Pump, for exhausting a great Quantity of Air, and also makes a more complete Vacuum than any known - - -		63 0 0
Condensing - Engine. This might be combined with the former, but it is much more useful and advantageous separate - - -		10 10 0
Apparatus for the above, according to the Number of Instruments for making the various Experiments -	10 0 0 to	50 0 0
Air - Guns, with Apparatus complete - - -	18 18 0 to	
Hydrostatic Balances - - -	3 3 0 to	10 10 0
Hydrometers, for Spirits, for Brewing, and for Infusions, of all Kinds - - -	2 12 6 to	4 14 6
Glass Bubbles for proving Rum, Proof-Phials - - -	0 10 6 to	0 18 0
Hydrostatic Bellows - - -		
Glass Models of the different Kinds of Pumps - - -		
Hiero's Fountain - - -		
Copper Fountains, by condensed Air, with Sets of Jets -	5 5 0 to	
Also all the Instruments in Hydrostatics and Hydraulics.		

 Pullies

	£. s. d.	£. s. d.
Pullies of different Combinations - -		
The Whirling-Table, or Centrifugal Machine, with all its Apparatus, for demonstrating the counteracting Powers of Motion and Attraction, by explaining the Copernican or Solar System, representing the Laws of Gravitation and various Phænomena in Nature and Philosophy - -		21 0 0
The Regular Solids, or Platonic Bodies, cut in Wood -		
The Dissected Cone - -		
The Mechanic Powers neatly made in Brass - -		26 5 0
Attwood's Apparatus for demonstrating the Laws of accelerated or retarded Motion - - - -		26 5 0
And many other Instruments in Mechanics.		

Magnetical Apparatus -				9 9 0
Horse-Shoe Magnets - -	0	2	0	to
Combined ditto - -	0	18	0	to
Bar-Magnets, in Sets - -	1	1	0	to
Dipping-Needles, Marine -				25 4 0
Ditto, Land - -				26 5 0
Variation-Compasses - -				21 0 0

Also all other Optical, Mathematical, and Philosophical, Instruments, according to the latest Improvements.





